

## CLAIMS

What is claimed is:

1. A method for receiving a plurality of data signals over an antenna array having a plurality of antenna elements, the data signals transmitted over a shared spectrum in a wireless communication system, the method comprising:

receiving a signal over each antenna element having each of the data signals;  
grouping the plurality of data signals into a plurality of groups;  
matched filtering the received signals of the antenna elements for a first group of the plurality of groups, producing a matched filtered result;  
jointly detecting data of the first group using the matched filtered result;  
constructing an interference correction signal using the detected data for each antenna element;  
subtracting from the received signal of each antenna element the interference correction signal for that element, producing an interference cancelled result for each antenna element; and  
successively detecting data of remaining groups using the interference cancelled result for each antenna element.

2. The method of claim 1 wherein the grouping of the plurality of data signals comprises measuring a combined power of each data signal as received by each antenna element and grouping together data signals having a substantially similar combined power.

3. The method of claim 1 wherein the jointly detecting data is performed using a zero forcing block linear equalizer.

4. The method of claim 1 wherein the jointly detecting data is performed using a minimum mean square error block linear equalizer.

5. The method of claim 1 wherein the jointly detecting data produces soft symbols and the method further comprising converting the soft symbols into hard symbols prior to interference correction signal construction.

6. A base station for receiving a plurality of data signals over an antenna array having a plurality of antenna elements, the data signals received over a shared spectrum in a wireless communication system, the base station comprising:

each antenna element for receiving a signal having each of the data signals;  
means for grouping the plurality of data signals into a plurality of groups;  
means for matched filtering the received signals of the antenna elements for a first group of the plurality of groups, producing a matched filtered result;

means for jointly detecting data of the first group using the matched filtered result;

means for constructing an interference correction signal using the detected data for each antenna element;

means for subtracting from the received signal of each antenna element the interference correction signal for that element, producing an interference cancelled result for each antenna element; and

means for successively detecting data of remaining groups using the interference cancelled result for each antenna element.

7. The base station of claim 6 wherein the means for grouping of the plurality of data signals comprises means for measuring a combined power of each data signal as received by each antenna element and means for grouping together data signals having a substantially similar combined power.

8. The base station of claim 6 wherein the means for jointly detecting data uses a zero forcing block linear equalizer.

9. The base station of claim 6 wherein the means for jointly detecting data uses a minimum mean square error block linear equalizer.

10. The base station of claim 6 wherein the means for jointly detecting data produces soft symbols and the base station further comprising a soft to hard decision device for converting the soft symbols into hard symbols prior to input into the means for interference correction signal construction.

11. A base station for receiving a plurality of data signals over an antenna array having a plurality of antenna elements, the data signals received over a shared spectrum in a wireless communication system, the base station comprising:

each antenna element for receiving a signal having each of the data signals;

a matched filter for matched filtering the received signals of the antenna elements for a first group of a plurality of groups, producing a first matched filtered result, the plurality of data signals are grouped into the plurality of groups;

a first joint detector for jointly detecting data of the first group using the first matched filtered result;

an interference correction construction device for constructing an interference correction signal using the detected data for each antenna element;

a plurality of subtractors for subtracting from the received signal of each antenna element the interference correction signal for that element, producing an interference cancelled result for each antenna element; and

a matched filter for matched filtering the produced interference cancelled result of the antenna elements for a second group of the plurality of groups, producing a second matched filtered result, the plurality of data signals are grouped into the plurality of groups; and

a second joint detector for jointly detecting data of the second group using the second matched filtered result.

12. The base station of claim 11 wherein the grouping of the plurality of data signals comprises measuring a combined power of each data signal as received by each antenna element and grouping together data signals having a substantially similar combined power.

13. The base station of claim 11 wherein the first and second joint detectors use a zero forcing block linear equalizer.

14. The base station of claim 11 wherein the first and second joint detectors use a minimum mean square error block linear equalizer.

15. The base station of claim 11 wherein the first and second joint detectors produce soft symbols and the base station further comprising a first and second soft to hard decision devices for converting the soft symbols into hard symbols.

16. A wireless transmit/receive unit for receiving a plurality of data signals over an antenna array having a plurality of antenna elements, the data signals received over a shared spectrum in a wireless communication system, the wireless transmit/receive unit comprising:

- each antenna element for receiving a signal having each of the data signals;
- means for grouping the plurality of data signals into a plurality of groups;
- means for matched filtering the received signals of the antenna elements for a first group of the plurality of groups, producing a matched filtered result;
- means for jointly detecting data of the first group using the matched filtered result;
- means for constructing an interference correction signal using the detected data for each antenna element;

means for subtracting from the received signal of each antenna element the interference correction signal for that element, producing an interference cancelled result for each antenna element; and

means for successively detecting data of remaining groups using the interference cancelled result for each antenna element.

17. The wireless transmit/receive unit of claim 16 wherein the means for grouping of the plurality of data signals comprises means for measuring a combined power of each data signal as received by each antenna element and means for grouping together data signals having a substantially similar combined power.

18. The wireless transmit/receive unit of claim 16 wherein the means for jointly detecting data uses a zero forcing block linear equalizer.

19. The wireless transmit/receive unit of claim 16 wherein the means for jointly detecting data uses a minimum mean square error block linear equalizer.

20. The wireless transmit/receive unit of claim 16 wherein the means for jointly detecting data produces soft symbols and the wireless transmit/receive unit further comprising a soft to hard decision device for converting the soft symbols into hard symbols prior to input into the means for interference correction signal construction.

21. A wireless transmit/receive unit for receiving a plurality of data signals over an antenna array having a plurality of antenna elements, the data signals received over a shared spectrum in a wireless communication system, the wireless transmit/receive unit comprising:

each antenna element for receiving a signal having each of the data signals;

a matched filter for matched filtering the received signals of the antenna elements for a first group of a plurality of groups, producing a first matched filtered result, the plurality of data signals are grouped into the plurality of groups;

a first joint detector for jointly detecting data of the first group using the first matched filtered result;

an interference correction construction device for constructing an interference correction signal using the detected data for each antenna element;

a plurality of subtractors for subtracting from the received signal of each antenna element the interference correction signal for that element, producing an interference cancelled result for each antenna element; and

a matched filter for matched filtering the produced interference cancelled result of the antenna elements for a second group of the plurality of groups, producing a second matched filtered result, the plurality of data signals are grouped into the plurality of groups; and

a second joint detector for jointly detecting data of the second group using the second matched filtered result.

22. The wireless transmit/receive unit of claim 21 wherein the grouping of the plurality of data signals comprises measuring a combined power of each data signal as received by each antenna element and grouping together data signals having a substantially similar combined power.

23. The wireless transmit/receive unit of claim 21 wherein the first and second joint detectors use a zero forcing block linear equalizer.

24. The wireless transmit/receive unit of claim 21 wherein the first and second joint detectors use a minimum mean square error block linear equalizer.

25. The wireless transmit/receive unit of claim 21 wherein the first and second joint detectors produce soft symbols and the wireless transmit/receive unit further comprising a first and second soft to hard decision devices for converting the soft symbols into hard symbols.